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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER

LANDAU, MATTHEW C

ART UNIT PAPER NUMBER

2815

DATE MAILED: 08/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/765,301

Applicant(s)

LESLIE, TERRENCE C.

Examiner

Matthew Landau

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 May 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-40 and 71-73 is/are pending in the application.
- 4a) Of the above claim(s) 5-7, 21-23, 28 and 29 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 8-20, 24-27, 30-40 and 71-73 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>2/16/06, 5/5/06, 5/18/06</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

Claims 5-7, 21-23, 28, and 29 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-4, 8-20, 24-27, 30-40, and 71-73 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Regarding claim 1, the limitation “wherein the selective epitaxy mesa comprises a portion of a buried conductive path, and wherein a region of the selective epitaxy mesa adjacent to the buried conductive path includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type” is not sufficiently supported by the originally filed application. The limitation refers to a first region (“a portion of a buried conductive path”) and a second region (“a region of the selective epitaxy mesa adjacent to the buried conductive path”). Since the first region is part of the conductive path, then the second region, which is adjacent to the conductive path, must be referring to a separate region.

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In terms of Applicant's drawings (Figures 4A and 4B), if the first region refers to region 37, then the second region must refer to the portion of region 36 above region 37 (as in Figure 4A) or the portion of region 36 in the middle of region 37 (as shown in Figure 4B). However, since region 36 is undoped, it cannot have a dopant profile and consist essentially of dopant of one conductivity type as required by the claim. Therefore, the above limitation constitutes new matter. Note that claim 9 has the same problem, while claims 16, 26, and 31 have very similar problems, despite a difference in wording (electrical signal line or bit line instead of conductive path).

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-4, 8-20, 24-27, 30-40, and 71-73 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 1, the limitation "wherein the selective epitaxy mesa comprises a portion of a buried conductive path, and wherein a region of the selective epitaxy mesa adjacent to the buried conductive path includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type" renders the claim indefinite. It is unclear what is meant by this limitation. Does this mean that the "a region of the selective epitaxy mesa adjacent to the buried conductive path" is a separate region from "a portion of a buried conductive path"? Or are both limitations referring to the same region? As shown in Figures 4A and 4B (of the present

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application), it appears “a portion” from the limitation “the selective epitaxy mesa comprises a portion of a buried conductive path” refers to region 37. Therefore, does the limitation “a region of the selective epitaxy mesa adjacent to the buried conductive path” also refer to region 37, or does it refer to the portion of region 36 above region 37 (as in Figure 4A) or the portion of region 36 in the middle of region 37 (as shown in Figure 4B). If region 37 is part of the conductive path, it would be improper to say it is adjacent the conductive path. However, since region 36 is undoped, it cannot have a dopant profile and consist essentially of dopant of one conductivity type as required by the claim. It appears from the specification and drawings that both limitations are referring to the same region. If so, it is suggested Applicant amend the claim to clarify that point. If not, then the limitations constitute new matter as indicated above. Note that claim 9 has the same problem, while claims 16, 26, and 31 have very similar problems, despite a difference in wording (electrical signal line or bit line instead of conductive path).

Further regarding claims 16 and 26, the limitation “the selective epitaxy mesa including a first source/drain region adjacent the substrate and in electrical communication with the electrical signal line, wherein a portion of the selective epitaxy mesa comprises a conductive portion of the electrical signal line” renders the claim indefinite. It is unclear if the first source/drain region refers to the same region as “a conductive portion of the electrical signal line”. As shown in Figures 4A and 4B (of the present application) it appears “a conductive portion of the electrical signal line” refers to region 37. Region 37 is also the first source/drain region. It seems improper to say the same region can be part of the electric signal line (a conductive portion of the electrical signal line) and also be “in electrical communication with” the signal line as required

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by the claim. Perhaps the limitations are merely redundant. It is suggested Applicant amend the claim to clarify this point.

Further regarding claim 31, does “a first doped region” also refer to the same region as “a portion of the selective epitaxy body” and “a region of the selective epitaxy body”? It appears from the specification and drawings that it does. All three regions appear to be represented as region 37 in Figures 4A and 4B.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 8-11, 16-18, 24-27, and 71-73 are rejected under 35 U.S.C. 102(b) as being anticipated by Fitch et al. (US Pat. 5,451,538, hereinafter Fitch).

Regarding claims 1 and 9, Figure 10 of Fitch discloses a substrate 12; a vertical access device including a selective epitaxy mesa (28, 30, 32, and 34), wherein the selective epitaxy mesa comprises a portion of a buried conductive path (28/14), and wherein a region 30 of the selective epitaxy mesa adjacent to the buried conductive path includes a laterally non-graded dopant profile consisting essentially of dopant of one conductivity type (col. 4, lines 60-63); and a storage device 69 on the selective epitaxy mesa. Note that Figure 4 of Fitch discloses that layers 28, 30, 32, and 34 are selectively formed by epitaxial growth techniques (col. 4, lines 30-

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36). Also note that Fitch discloses region 14 is the bit line (col. 7, lines 46-48), and therefore inherently has a conductive path. Region 28 can be considered part of that conductive path since it is electrically connected to region 14.

Regarding claim 2, Figure 10 of Fitch discloses the selective epitaxy mesa (28, 30, 32, and 34) includes a bottom source/drain (S/D) 28 and a top S/D 32/34, and a conductive body 30 separating the bottom S/D from the top S/D.

Regarding claim 3, Fitch discloses the bottom S/D region 28 is an in situ doped region (col. 4, lines 43-48).

Regarding claim 4, Fitch discloses the top S/D region 32/34 is an in situ doped region (col. 5, lines 3-10).

Regarding claim 8, Figure 10 of Fitch discloses the access device is free from a shallow trench isolation layer.

Regarding claim 10, Fitch discloses the substrate 12 includes silicon (col. 3, line 10), and wherein the selective epitaxy mesa includes silicon (col. 4, lines 36-41).

Regarding claim 11, Figure 10 of Fitch discloses the access device includes a body 30, a first S/D region 28, a gate 18 and a second S/D region 32/34, wherein the body extends between the first S/D region and the second S/D region, and wherein the first S/D region and the second S/D region are each a selective epitaxy doped region of the selective epitaxy mesa (col. 4, lines 43-48 and col. 5, lines 3-10).

Regarding claims 16 and 26, Figure 10 of Fitch discloses a substrate 12; an electrical signal line (bit line) 14 (col. 7, lines 46-48) on the substrate; an access device including: a selective epitaxy mesa (28/30/32/34) formed on and extending outwardly from the substrate, the

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selective epitaxy mesa including a first S/D region 28 adjacent the substrate and in electrical communication with the electrical signal line, wherein a portion 28 of the selective epitaxy mesa comprises a conductive portion of the electrical signal line, and wherein a region (28 or 30, depending on how the claim language is interpreted) of the selective epitaxy mesa adjacent to the electrical signal line includes a lateral non-graded dopant profile consisting essentially of dopant atoms of one conductivity type (col. 4, lines 43-48), the selective epitaxy mesa further including a body 30 extending vertically from the first S/D region 28, an insulator 22 on the body, and a gate 18 on the insulator; and a storage device 69 on the selective epitaxy mesa. Note that region 28 can be considered part of the signal line path since it is electrically connected to region 14.

Regarding claim 17, Figure 10 of Fitch discloses the electrical signal line 14 has a first height (depth), and wherein the first S/D region 28 has a second height equal to or less than the first height.

Regarding claim 18, Figure 10 of Fitch discloses the selective epitaxy mesa (28/30/32/34) cantilevers upwardly from the substrate, and wherein the selective epitaxy mesa includes an end, remote from the substrate, forming a second S/D region 32/34.

Regarding claim 24, Figure 10 of Fitch discloses the first S/D region 28 is adapted to electrically communicate with a column address decoder through a buried bit line 14.

Regarding claim 25, Figure 10 of Fitch discloses the second S/D region is adapted to electrically communicate with the storage device.

Regarding claim 27, Figure 6 of Fitch discloses the insulator 22 surrounds the body 30, and wherein the gate 18 surrounds the insulator such that the gate effects electrical conductivity of the body from more than one angle.

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Regarding claim 71, Figure 10 of Fitch discloses the selective epitaxy mesa includes a region of polycrystalline silicon (col. 5, lines 44-46).

Regarding claims 72 and 73, Figure 10 of Fitch discloses the region 30 of the selective epitaxy mesa adjacent to the buried conductive path comprises at least one abrupt p-n junction (the junction between region 30 and region 28). Region 30 is abruptly doped.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fitch in view of Kurjanowicz et al. (US PGPub 2002/0131291, hereinafter Kur).

Regarding claim 30, Fitch discloses the electrical signal line (word line) 18 is made of polysilicon (col. 3, lines 15-18). The difference between Fitch and the claimed invention is the signal line includes titanium. Kur discloses using titanium silicided wordlines (paragraph [0006], last 5 lines). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Fitch by included a layer of titanium silicide on the signal line for the purpose of reducing the effective resistance (see last 5 lines in paragraph [0006] of Kur).

Claims 31-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fitch in view of Chew et al. (US Pat. 6, 518,622, hereinafter Chew).

Regarding claims 31 and 32, Figure 10 of Fitch discloses a vertical, selective epitaxy body (28/30/32/34) extending from a horizontal substrate 12 such that a portion of the selective epitaxy body is adapted to comprise a vertical portion 28 of a buried bit line 14 (col. 7, lines 46-48), wherein a region 28 of the selective epitaxy body adjacent to the vertical portion includes a laterally non-graded dopant profile consisting essentially of dopant of once conductivity type; a first doped region 28 in the body adjacent the substrate; a second doped region 32/34 in the body remote from the substrate; an intermediate region 30 (channel region) between the first doped region and the second doped region; and a gate 18 at least partially surrounding the intermediate region. Note that region 28 can be considered part of the bit line since it is electrically connected to region 14. The difference between Fitch and the claimed invention is the intermediate region (channel region) is undoped. Figure 6 of Chew discloses a vertical access device with an undoped, epitaxial channel region 605 (col. 4, lines 30-34). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Fitch by using an undoped channel region for the purpose of simplifying the production process (by eliminating the doping step).

Regarding claim 33, Figure 10 of Fitch discloses the first doped region 28 is in electrical communication with the bit line 14.

Regarding claim 34, Figure 10 of Fitch discloses the gate 18 is adapted to be in electrical communication with a word line 18 (col. 7, lines 45 and 46). Note that the portion of the word line 18 adjacent to the dielectric layer 22 functions as the gate.

Regarding claims 35-40, Figures 6 and 10 of Fitch discloses the gate 18, overlies about all of the surface area of the intermediate region 30, the gate is generally annular and extends completely around the body, and the vertical epitaxy body is cylindrical. Since the first doped region is part of the epitaxy body, it is also cylindrical.

Response to Arguments

Applicant's arguments with respect to the pending claims have been considered but are moot in view of the new ground(s) of rejection. Although the same reference is applied (Fitch), the rejections are based on a new interpretation of that reference. Therefore, the arguments presented in response to the interpretation used in the previous Office Action are no longer applicable.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO**

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MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is (571) 272-1731.

The examiner can normally be reached from 8:30 AM - 5:30 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on (571) 272-2298. The fax phone numbers for the organization where this application or proceeding is assigned are (571) 273-8300 for regular communications and (571) 273-8300 for After Final communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should any questions arise regarding access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



KENNETH PARKER
SUPERVISORY PATENT EXAMINER

Matthew C. Landau

April 21, 2006